

Cross-Reference to Related Applications

None

Statement Regarding Federally Sponsored Research or Development

Not Applicable

BACKGROUND OF THE INVENTIONField of the Invention

This invention relates generally to a weight distribution surface for arching lumbar support devices, for seats.

Related Art

Lumbar supports for seats, particularly automobile seats, are known. *See* U.S. Patent Nos. 4,354,709; 4,452,485; 4,632,454; 4,880,271; 5,050,930; 5,397,164; 5,498,063; 5,626,390; 5,775,773; 6,003,941; GB 2 013 487A and D 169 293 B1. These devices all have in common a pressure surface that may be flexed in order to create a convex surface with its apex towards the lumbar spine of a human being sitting in the seat into which the device is incorporated. This convex flexion is induced by any of a great variety of means for compression, *see, e.g.*, U.S. Patent No. 4,354,709, or tension, *see, e.g.*, U.S. Patent No. 5,498,063. Typical prior art lumbar supports have both an upper extremity of the convex pressure element and a lower extremity of it anchored to a framework within the seat. These upper and lower elements are tensioned or compressed to move closer together to project the apex of the convexity farther out from the plane of the seat for greater lumbar support. Conversely, tension is released in order to move the apex of the convexity closer to the plane of the seat for less lumbar support. These devices provide little flexibility in the surface of the

5 support proximal to the seat occupant, because that surface is encapsulated and under tension or compression.

All of these prior art lumbar supports are limited in the flexibility they are able to provide the surface that applies pressure to the passenger. Such pressure surface rigidity is less comfortable for the passenger.

10 Moreover, as seat designs are modified to incorporate more comfort devices, such as duct work for heating and cooling, the amount of space available inside seats for lumbar support devices shrinks. Smaller lumbar supports save space, but exacerbate the issue of pressure surface inflexibility and distribution of weight support.

There is a need in the art for a an ergonomic weight support which is more flexible at the surface that applies pressure to the passenger, which occupies no more space than prior supports, and which is inexpensive and easy to manufacture and install.

### Summary of the Invention

This invention is a weight distribution surface for ergonomic supports for seats, especially automobile seats.

20 The present invention uses a relatively small number of moving parts which are simple in design and movement. It is compact in size for ease of packaging and ease of incorporation into a variety of different seats including automobile seats. It may be incorporated at various positions and in various orientations. The present invention is economical to manufacture, sell, assemble, maintain and operate. It may be operated by a motor, mechanical means or a  
25 combination of the two. More than one support device may be incorporated in a single seat for a plurality of ergonomic supports, including but not limited to lumbar support, head/neck support, rib support and/or thigh support.

5 It is able to tolerate excessive or abusive loads.

The present invention eases and streamlines the manufacture of the device and of seats incorporating the device, to lower production costs and increase durability and useable life of the device and seats incorporating it. It may be incorporated easily with existing components, as, for example, seat frames or headrests, and with future seats which may have less space  
10 available within them. It does not require guide wires, outside actuators, attachment brackets or long cables.

Further features and advantages of the present invention, as well as the structure and operation of various embodiments of the present invention, are described in detail below, with reference to the accompanying drawings.

### **Brief Description of the Drawings**

Figure 1 is a perspective view of the weight distribution surface of the present invention combined with a conventional traction arching type lumbar support.

Figure 2 is a side view of the weight distribution surface of the present invention combined with a traction arching lumbar support in the flat position.

20 Figure 3 is a side view of the weight distribution surface of the present invention combined with a traction arching lumbar support in the extended position.

### **Detailed Description of the Preferred Embodiments**

Referring to the accompanying drawings in which like reference numbers indicate like elements, Figure 1 is a perspective view of the weight distribution surface of the present  
25 invention combined with a traction arching lumbar support. A seat frame, 10, has guide rails, 12, mounted on it. A conventional arching pressure surface, 14, is mounted on guide rails, 12, so that it can slide vertically along the guide rails, 12, at both its upper end, 16, and its lower

5 end, 18. Various alternative traction arching lumbar supports have an upper or lower end of  
the arching pressure surface, 14, that are fixed and pivot without sliding along guide rails. The  
weight distribution surface of the present invention applies equally well to any such  
configuration. The archable pressure surface, 14, is arched by means of a traction device.  
Single bowden cables are often used to apply arching traction. In the depicted alternative  
10 embodiment, two bowden cables, 20 and 22, are attached to the lumbar support. Each bowden  
cable has a wire, 24, sliding axially through it. Any of a variety of configurations of bowden  
cable traction application are known in the art. In the depicted embodiment, bowden cable,  
20, has its conduit or sleeve attached to a spring, 26, which is fixed at a bracket, 28. The wire,  
24, extends out of the sleeve of bowden cable, 20, and is fixed to the lower end, 18, of arching  
15 pressure surface, 14. Spring, 26, mediates the tension applied through bowden cable, 20, and  
helps the unit tolerate abusive loads. A traction actuator, 30, powered by an electric motor, 46,  
may draw the wire, 24, into the sleeve of bowden cable, 20. The effect of this traction would  
be to draw lower end, 18, of arching pressure surface, 14, towards bracket, 28, creating an arch  
in the previously flat arching pressure surface, 14.

20 In the depicted alternative embodiment, an arch may also be created by the other  
bowden cable, 22, through a similar application of traction acting through a similar fixation of  
the sleeve end of bowden cable, 22, and the bowden cable wire end, which is obscured in Figure  
1. The effect of this traction is depicted, with top end, 16, of arching pressure surface, 14,  
being drawn down to create the arch depicted in figures 1 and 3. In either direction, actuator,  
25 30, can put traction on either bowden cable, 20 or 22, which arches the pressure surface, 14,  
from a flat to an arched position.

5 Arching pressure surface, 14, forms a pre-configured curve when it is arched. The arch has a pre-configured apex. Being under tension, arching pressure surface, 14, is relatively inflexible. This degree of rigidity is not optimally comfortable for all potential seat occupants. Rigid support is not optimally comfortable for a single occupant who may be in an automobile or an office furniture seat for a long period of time. Distribution of the seat occupant's weight  
10 across the lumbar supporting curve is more comfortable and more ergonomically beneficial if that weight is flexibly distributed. The weight distribution surface of the present invention more flexibly distributes the passenger's weight support when it is combined with the known traction arching lumbar support systems.

Weight distribution surface, 32, is fixedly attached to arching pressure surface, 14. The  
15 fixation point is at or near the apex of arching pressure surface, 14. Fixation may be had by any conventional means including without limitation, rivets, bolts, screws, spot welds and the like. In the depicted alternative embodiment, rivets, 34, fix weight distribution surface, 32, to arching pressure surface, 14. Like arching pressure surface, 14, the weight distribution surface, 32, may be made of a variety of materials, for example plastic or stamped metal. It may also  
20 be fabricated in a variety of ways, for example, molding plastic, stamping a single metal sheet, or fabricating an assembly of vertical members and lateral members. The weight distribution surface may be a flat solid surface, a surface having holes, or, as depicted, a surface having two vertical bands, 36, and several lateral cross members or ribs, 38.

The weight distribution achieved by the weight distribution surface of the present  
25 invention is achieved by maintaining its upper and lower aspects free of any fixation to the seat frame, guide rail assembly or arching pressure surface. Lower portion, 42, and upper portion, 44, of weight distribution surface, 32, hang freely, thus allowing their flexion when the seat

5 occupant's weight is reclined against the lumbar support. The only fixation point of weight distribution surface, 32, is at apex rivets, 34.

Figure 2 is a side view of a typical traction arching lumbar support incorporating the weight distribution surface of the present invention. It is apparent that in the lumbar support's flat position, the weight distribution surface, 32, adds very little bulk or thickness to  
10 the overall profile of the lumbar support unit. Weight distribution surface, 32, rests flat upon the flat arching pressure surface, 14, and is disposed flush with it on guide rails, 12.

Figure 3 is a side view of a traction arching lumbar support incorporating the weight distribution surface of the present invention, in the arched position. Figure 3 illustrates that while the upper end, 16, and lower end, 18, of arching pressure surface, 14, remain on guide rails, 12, the upper end, 44, and lower end, 42, of weight distribution surface, 32, are not fixed to any other part of the lumbar support unit. Weight distribution surface, 32, remains fixed to arching pressure surface, 14, only at apex rivets, 34. Accordingly, the lumbar supporting pressure of arching pressure surface, 14, is transferred to support the weight of a seat occupant reclining against the lumbar support in a distribution mediated by the weight distribution  
20 surface, 32, in order to flexibly accommodate the varying spines of various seat occupants, and alterations in the posture of a single occupant over time.

It will be appreciated by those of skill in the art that the flexible weight distribution surface of the present invention may either be designed as an integral part of newly developed lumbar supports, and may also be retrofitted to conventional lumbar supports. It is a further  
25 advantage of the present invention that it is simple to affix to pressure surfaces used in traction arching type lumbar supports and therefore efficient and economical in its assembly, distribution and installation.

5           The flexible pressure plate of the present invention promotes passenger comfort by spreading the force of the lumbar support over a greater vertical range, which is more ergonomically appropriate for the human spine which extends over a range greater in its vertical dimension than current lumbar supports.

10           An alternative embodiment of the flexible pressure plate is tapered so that it is thicker at the apex of the lumbar support, at or near its fixation points, 34, and then tapers to a thinner depth towards its upper and lower edges. Such a design further promotes the flexibility of the pressure plate of the present invention.

15           The flexible pressure plate of the present invention is depicted as ribbed in the figures. It is considered to be within the scope of the present invention for the flexible pressure plate to be any shape, including without limitation rounded, rectangular circular, elliptical, waisted, ribbed or otherwise.

20           The present invention is advantageous in that it allows for greater freedom in mounting options than previously possible. The present invention may be mounted by bolts, springs, clamps, rivets, snaps, hooks, or any such equivalent. It may also be mounted "in suspension," that is, in cooperation with conventional wire or spring webs used to support a passengers weight. No mounting guide wires or rods are necessary, which further conserves space.

          In view of the foregoing, it will be seen that the several advantages of the invention are achieved and attained.

25           The embodiments were chosen and described in order to best explain the principles of the invention and its practical application to thereby enable others skilled in the art to best utilize the invention and various embodiments and with various modifications as are suited to the particular use contemplated.

5           As various modifications could be made in the constructions and methods herein  
described and illustrated without departing from the scope of the invention, it is intended that  
all matter contained in the foregoing description or shown in the accompanying drawings shall  
be interpreted as illustrative rather than limiting. Thus, the breadth and scope of the present  
invention should not be limited by any of the above described exemplary embodiments, but  
10 should be defined only in accordance with the following claims appended hereto and their  
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